

STEP FOUR: EVALUATE EFFECTS OF ALTERNATIVE PLANS

Planning Principles & Procedures - FY11



US Army Corps of Engineers
BUILDING STRONG®



OBJECTIVE

- DEFINE EVALUATION
- DESCRIBE STEPS IN EVALUATION PROCESS



EVALUATION

- QUANTIFY AND JUDGE CONTRIBUTIONS OF PLANS
- ASSESSMENT: Measure/ quantify differences
- APPRAISAL: Judge/ weight differences
- FIND VALUE OR WORTH OF PLANS
- IDENTIFY PLANS to carry through to COMPARISON
- RE-FORMULATE & RE-EVALUATE as necessary



EVALUATION AND COMPARISON

- EVALUATION - LOOK AT PLAN ON ITS OWN MERITS
(With project vs. Without project conditions)
- COMPARISON - CONTRAST THE MERITS AMONG PLANS
(Plan vs. Plan)



EVALUATION STEPS

- FORECAST WITH PROJECT CONDITION
- COMPARE WITH PLAN TO WITHOUT
- ASSESS EFFECTS
- APPRAISE EFFECTS
- QUALIFY PLANS – for further consideration, or drop them



FORECAST “WITH PROJECT” CONDITION

<i>EFFECT</i>	<i>WITHOUT CONDITION</i>	<i>PLAN A CONDITION</i>
<i>POPULATION</i>	147,000	147,000
<i>ANNUAL DAMAGES</i>	\$2.1 Million	\$0.7 Million
<i>WETLAND ACRES</i>	412	458
<i>HABITAT UNITS</i>	206	246
<i>RECREATION (USER DAYS)</i>	5,000	25,000



EVALUATION STEPS

- FORECAST WITH PROJECT CONDITION
- COMPARE WITH PLAN TO WITHOUT
- **ASSESS EFFECTS**
- APPRAISE EFFECTS
- QUALIFY PLANS



ASSESS EFFECTS

- DESCRIBE AND MEASURE
 - ▶ Resources (ex: wetlands)
 - ▶ Plan outputs (ex: flood damages)
 - ▶ Plan effects (ex: community cohesion)

- IN TERMS OF:
 - ▶ Magnitude
 - ▶ Timing & duration
 - ▶ Location
 - ▶ Other characteristics



WITH VS WITHOUT

EFFECT	WITHOUT CONDITION	PLAN A CONDITION	DIFFERENCE
POPULATION	147,000	147,000	0
ANNUAL DAMAGES	\$2.1 Million	\$0.7 Million	\$1.4 million decrease downtown
WETLAND ACRES	412	458	46 acres increase along the river
HABITAT UNITS	206	246	40 HU increase in nature preserve
RECREATION (USER DAYS)	5,000	25,000	20,000 user-days increase in riverfront park



SIGNIFICANT EFFECTS

- INSTITUTIONAL
- PUBLIC
- TECHNICAL



INSTITUTIONAL SIGNIFICANCE

- The importance of an impact (effect) is recognized in laws, programs and policies:
- Federal:
 - ▶ Principles and Guidelines – NED & EQ impacts
 - ▶ ER 1105-2-100 – primary, secondary, incidental benefits
 - ▶ Endangered Species Act; Clean Water Act
 - ▶ Annual Budget EC 11-2-xxx (ex: for 2010 -193): provides ranking criteria (scarcity, connectivity, special status species, plan recognition, self-sustaining, cost/acre)
- State/Regional:
 - ▶ Laws creating non-Federal entities (Port Authorities, Flood Control Districts, etc.)
 - ▶ Ex: Chesapeake Bay Agreement
- Local/Tribal:
 - ▶ Budgets allocated for funds to restore, preserve, etc.



INSTITUTIONAL SIGNIFICANCE (LAWS)

- Water Resources Development Act
- Annual Appropriations Acts
- Clean Water Act of 1972 (section 404 permits)
- Wetlands Reserve Program
- Coastal Barrier Resources Act 1990
- Chesapeake Bay Agreement
- State Natural Heritage Programs
- Zoning Ordinances/Land Trusts



PUBLIC SIGNIFICANCE

- Non-profit organizations
 - ▶ Navigation users groups
 - ▶ Community organizations
- Grass roots support groups
 - ▶ Save the Bay, Save the Whales, Historic Preservation - Volunteer groups working to identify and preserve a resource
- Controversy over the use of resources
- Opposition to the destruction of a resource
- Public health & safety



TECHNICAL SIGNIFICANCE

- Engineering & Economic Sciences
 - ▶ Residual flooding in urban areas
 - ▶ Maintain existing levels of flood protection
 - ▶ Commercial transport
 - ▶ Net benefits, cost effectiveness/incremental cost
- Ecological and environmental sciences
- Human and animal health sciences
- Biological and life sciences



SIGNIFICANCE ATTRIBUTES

- Scarcity: relative abundance, rareness
- Representativeness: exemplifies natural, undisturbed habitat
- Status and trends: occurrence and extent over time, how and why changed
- Connectivity: habitat corridors, fragmentation, barriers
- Limiting habitat: essential to species survival
- Biodiversity: species richness, genetic variability



SIGNIFICANCE

- Can sources of significance overlap?
- YES!
- Ex: Wetlands
 - ▶ Institutional – protected by law
 - ▶ Technical – ecosystem functions
 - ▶ Public – public support



MAGNITUDE



NED - benefits & costs

EQ - habitat units, acres of wetlands, protected species, WQ (loads, concentrations), cultural resource sites & properties, etc.

RED - regional sales & income (\$), employment, local tax receipts, etc.

OSE - community cohesion - people displaced; prevention of loss of life & public safety; environmental justice, etc.



Examples of Effects Evaluated for the Indian River Lagoon Project (P&G Accounts)

- **NED**
 - Water supply benefits for irrigation
 - Flood protection (maintain existing levels of service)
 - Recreation, commercial fishing (qualitative)
- **RED**
 - Construction, real estate, and O&M: employment, earnings, & output
- **EQ**
 - Fish & wildlife resources
 - Protected species
 - Vegetation: terrestrial & marine
 - Essential fish habitat
 - Historic properties
 - Aesthetics
- **OSE**
 - Potential community disruption from conversion of agric land



Examples of Effects Evaluated for the Indian River Lagoon Project

▪ Hydrologic & Ecological Criteria

- **Avg annual nitrogen load to estuary (metric tons/ year)**
- **Avg annual phosphorus load to estuary (metric tons/ year)**
- **Avg annual phosphorus load to Lake Okeechobee (metric tons/ year)**
- **Existing wetlands restored (acres)**
- **Former wetlands restored -hydric soils (acres)**
- **Focal species habitat (acres)**
- **Flows to estuary to meet required salinity envelope (cfs)**



Examples of Effects to be Evaluated in Lake Okeechobee Watershed Study

- **Lake O Performance Measures - quantitative indicator of how well alternative meets planning objectives - alternatives are formulated to meet them**
 - **Phosphorus load reduction to Lake O**
 - **Exceedances of P load reduction target to Lake O**
 - **Storage (% of runoff stored when Lake O water levels high)**
 - **Increased Lake O inflows during dry conditions**
 - **Wetland restoration (total acres gained)**



Examples of Effects to be Evaluated in Lake Okeechobee Watershed Study

- **Lake O Evaluation Criteria**

- ▶ **Additional effects determined to be potentially important by the project delivery team, or required by laws, policies, regulations**
 - ▷ **Agricultural water supply**
 - ▷ **Flood damage potential to existing development**
 - ▷ **Net change in recreational potential**
 - ▷ **Ecologic value (eco values of sites to assess impacts)**
 - ▷ **Cultural resources impacts (# resources, spatial extent)**
 - ▷ **Socio-economic impacts (e.g., ag income, # residences)**
 - ▷ **Real Estate (# owners, # parcels)**
 - ▷ **Environ & Econ Equity (minority or low income pop. jobs)**
 - ▷ **Operational flexibility**



MAGNITUDE - TECHNIQUES

- PRINCIPLES AND GUIDELINES – NED, EQ
- ER 1105-2-100: Appendix D: Economic & Social Considerations; Appendix E: Civil Works Missions
- National Economic Development Manuals (IWR)
- Evaluation of Environmental Investments Research Program (IWR & ERDC)
- RED & OSE Handbooks under development (IWR)



PRODUCT OF ASSESSMENT

EFFECT	WITHOUT CONDITION	PLAN A CONDITION	DIFFERENCE
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Assessment Example from Indian River Lagoon Feasibility Study

EFFECT	Without Cond	ALT 2	ALT 3	ALT 4	ALT 5	ALT 6
Cost (\$1000)	\$0	\$22,089	\$47,965	\$53,629	\$51,702	\$50,689
Flow Reduction (ac-ft)	0	+151,200	+140,600	+137,340	+152,670	+160,546
Phosphorus Removed (Kg/yr)	0	+10,140	+69,066	+94,781	+87,228	+83,067
Wetlands Restored (acres)	0	0	+39,614	+54,827	+53,665	+53,665
Watershed Habitat (HU's)	23,352	0 (-23,352)	70,709 (+47,357)	86,301 (+62,949)	66,608 (+43,256)	66,608 (+43,256)
Estuarine Habitat (HU's)	27	290 (+263)	2,204 (+2,177)	3,542 (+3,515)	3,988 (+3,961)	4,435 (+4,408)
Etc...						



EVALUATION STEPS

- FORECAST WITH PROJECT CONDITION
- COMPARE WITH PLAN TO WITHOUT
- ASSESS EFFECTS
- **APPRAISE EFFECTS**
- QUALIFY PLANS



APPRAISE EFFECTS

- What is important?
- JUDGE IMPACTS
 - Positive, Negative, or Neutral?
 - How positive/ negative?
 - MOSTLY SUBJECTIVE
 - **Project Delivery Team**
 - P&G - EQ, RED, OSE
 - NED -
- WEIGHT SIGNIFICANCE
- USE P&G CRITERIA



Appraisal Example from Indian River Lagoon Feasibility Study

EFFECT	Without Cond	ALT 2	ALT 3	ALT 4	ALT 5	ALT 6
Air Quality	H	0	0	0	0	0
Threatened & Endangered Species	L	+	++	++	++	++
Coastal Zone	L	+	+	++	++	++
Aesthetic Values	M	0	+	+	++	++
Cultural Properties	M	-	-	-	-	-
Employment	M	+	+	+	++	++
Etc...						

Notes: Without cond relative resource values: H=High, M=Moderate L=Low.
 Net overall change from without plan: ++=very beneficial change; +=beneficial;
 0=no change; -=adverse change; --=very adverse change



EVALUATION STEPS

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QUALIFY PLANS

- IDENTIFY PLANS THAT DESERVE TO BE CARRIED FORWARD & COMPARED AGAINST EACH OTHER



EVALUATION STANDARDS

- MUST MEET MINIMUM STANDARDS
- CRITERIA TO DEFINE STANDARDS:
 - ▶ Planning objectives & constraints
 - ▶ Federal objective
 - ▶ Environmental compliance, consultation and coordination requirements
 - ▶ P&G criteria
 - ▶ Requirements specific to authorization
 - e.g., “Savings Clause” in WRDA 2000
 - ▶ Key stakeholders’ concerns



PLANNING OBJECTIVES

- Objective - Reduce current risk of damage due to flooding.
 - ▶ Does the plan achieve the objective?
 - ▶ To what extent is the objective met?
- Constraint – Maintain at least existing level of flood protection
 - ▶ Does the plan avoid/meet the constraint?



FEDERAL OBJECTIVE

- Contribution of plan to NED benefits.
- Ecosystem restoration - contribution of plan to NER benefits (Corps objective)



ENVIRONMENTAL CONSULTATION AND COORDINATION REQUIREMENTS

- Endangered Species
- Cultural Resources
- Fish and Wildlife CAR
- National Environmental Policy Act (NEPA)
- Others



PRINCIPLES AND GUIDELINES

- FOUR SUBJECTIVE CRITERIA:
 - ▶ COMPLETENESS
 - ▶ EFFECTIVENESS
 - ▶ EFFICIENCY
 - ▶ ACCEPTABILITY



A Note Regarding Iteration...

- Will re-formulation & re-evaluation occur?
 - ▶ Most likely!
- Why?
 - ▶ PDT learns from evaluations
 - ▶ More information becomes available
 - ▶ Our understanding improves
- Ex:
 - ▶ Initial science indicates correcting salinity levels will restore estuarine biota (PROBLEMS & OPPORTUNITIES)
 - ▶ So... alternatives are FORMULATED to deliver appropriate freshwater flows to estuary
 - ▶ Subsequent modeling (EVALUATION) indicates that correcting salinity & flows are insufficient to restore estuarine biota
 - ▶ So... alternatives are RE-FORMULATED to include measures to address additional WQ nutrient requirements
 - ▶ Subsequent modeling (RE-EVALUATION) quantifies improvements to biota resulting from re-formulated alternatives
 - ▶ And so on...

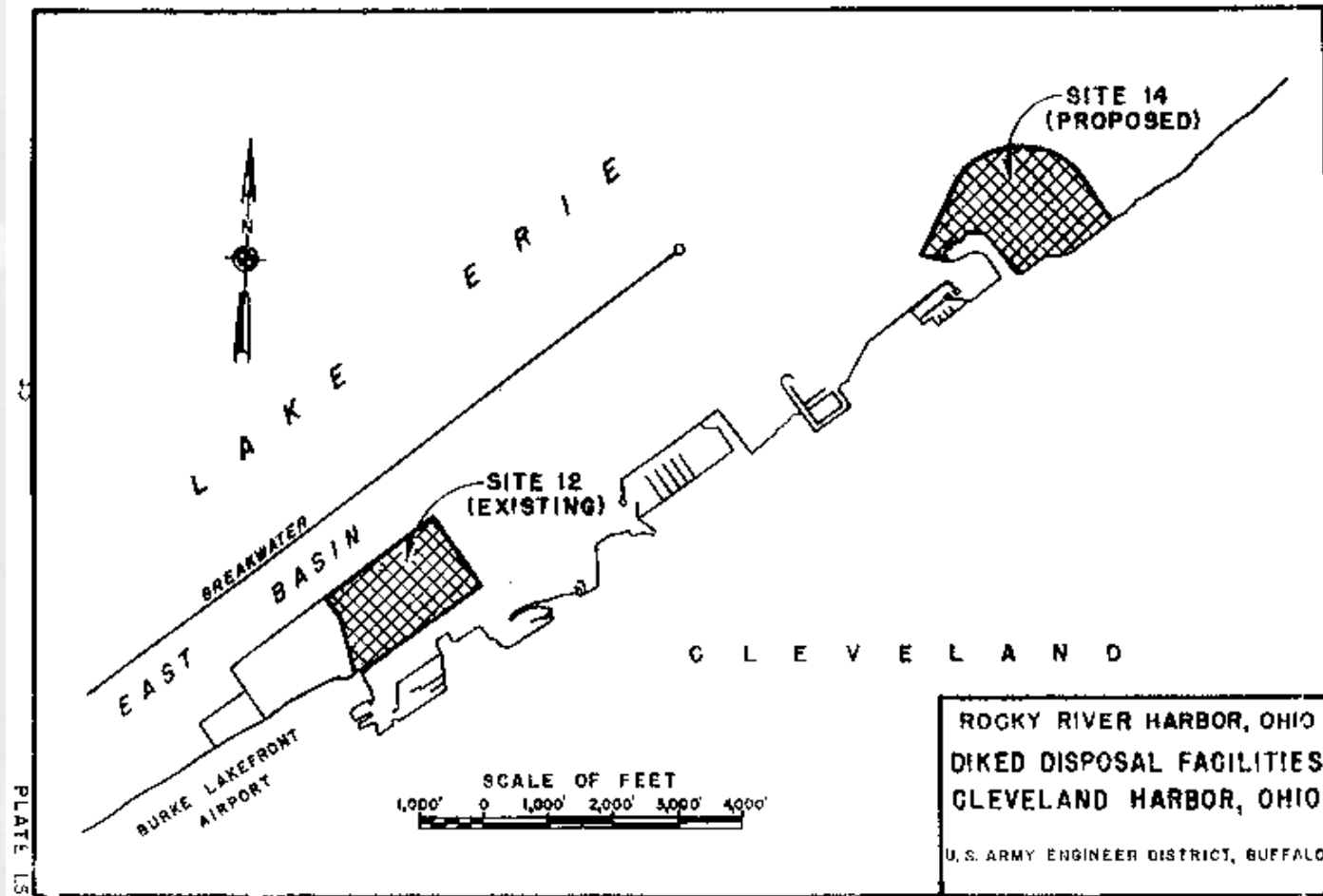


Review

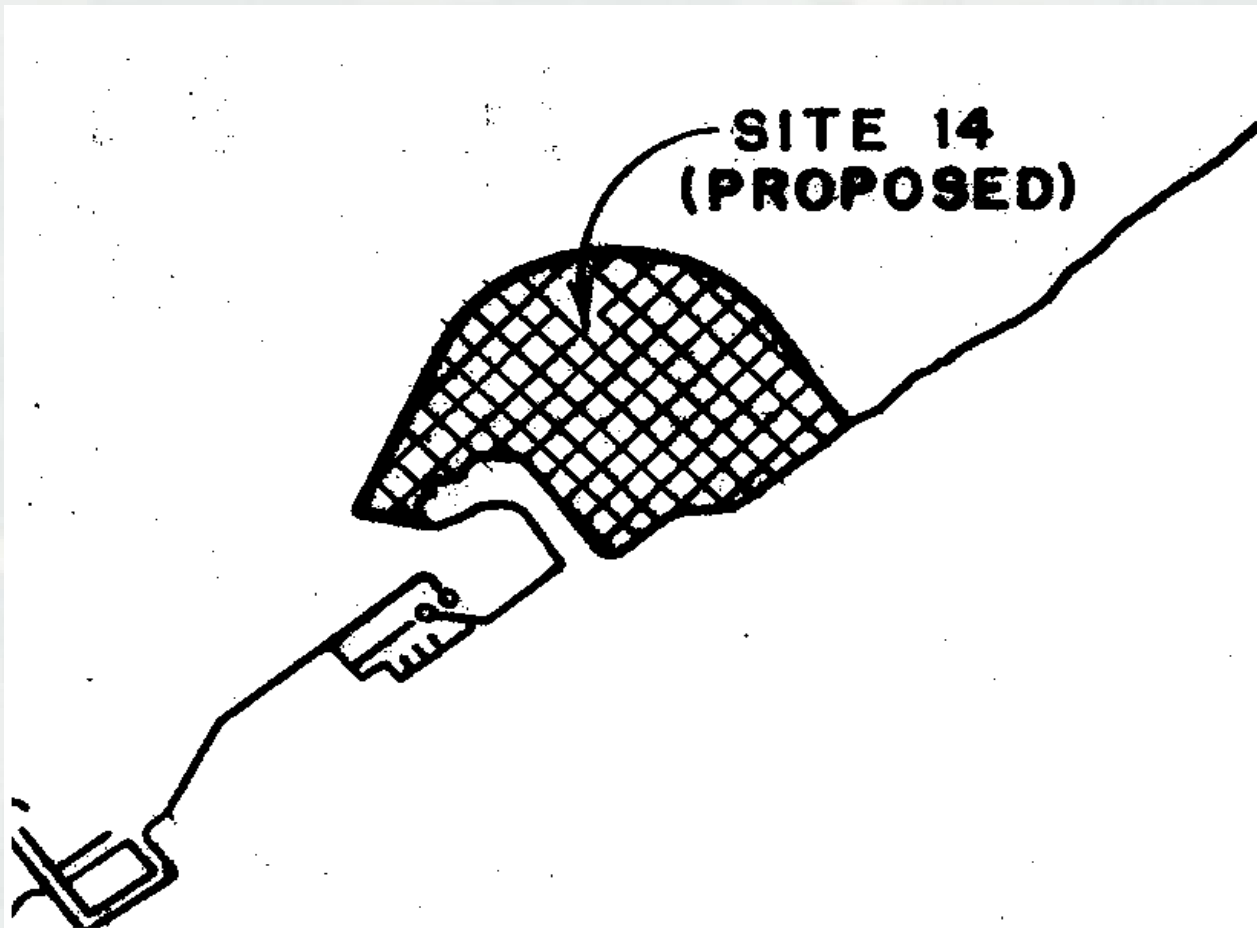
- Evaluation comprises objective Assessment & subjective Appraisal
- Effects measured as the difference between with & without project conditions
- Many procedures developed to quantify NED, NER, EQ, & physical effects of alternative plans
- 4 accounts provide flexible framework for identifying & summarizing plan effects
- Plans qualified for further consideration
- Re-evaluation (& re-formulation) often part of iterative planning process



Cleveland Harbor



Cleveland Harbor



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PLANS	ACHIEVEMENT OF OBJECTIVE	OTHER EVALUATION



EVALUATION METRICS

- + / 0 / -
- Ranking: #1 thru #N
- % of planning objective achieved
- Make up a metric

